Kankichi SOHMA*: Pollen morphology of *Dicerma biarticulatum* (L.) DC. (Leguminosae)

相馬寛吉*: *Dicerma biarticulatum* (L.) DC. の花粉形態の再検討

In examining a large number of herbarium specimens of *Dicerma biarticulatum* (L.) DC. from south-eastern Asia southwards through Malaysia to Australia, Ohashi (1973) attempted to separate the species into three subspecies in his monograph, "The Asiatic species of *Desmodium* and its allied genera." He presents an external morphological description of the species, accompanied by a fairly detailed description of the pollen by use of the light microscope. The present paper will detail a renewed and more intensive palynological study of *Dicerma biarticulatum* using both the light and scanning electron microscopes and will demonstrate the complementary nature of the two microscopes for a better understanding of pollen grains of the species.

Material and methods The polliniferous material from the specimen of *Dicerma biarticulatum* (L.) DC. subsp. *australiense* (Schindler) Ohashi was kindly placed at my disposal by Dr. H. Ohashi, Botanical Gardens, Faculty of Science, University of Tokyo. The specimen was selected from the list of those studied by Ohashi, loc. cit., and was originated from the collections deposited in the National Herbarium of New South Wales, Sydney, Australia. The data on the specimen is NSW 105342, collected by N. B. Tindale, s. n., at Upper Roper River, Groote, Australia.

Pollen used for light microscopy was prepared by standard acetolysis method and mounted in silicone oil. The material used for scanning electron microscope observation was cleaned by means of an alcohol-benzene-alcohol series, and coated with a gold film. Scanning electron micrographs were taken with a JEOL-SEM-3B.

I wish to thank Dr. H. Ohashi for the supply of the interesting material and for his kind cooperation in sending a set of the reference pollen slides of *Dicerma* illustrated in his work for re-examination. I am also indebted

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to Mr. M. Takahashi, Biological Institute, Tohoku University, for his assistance in preparing the scanning electron micrographs.

Results and discussion According to Ohashi's comprehensive description of *Dicerma biarticulatum* based on the materials both for subsp. *australiense* and subsp. *biarticulatum* (loc. cit., p. 254-255 & Pl. 73), pollen grains are tricolporate provided with coarsely reticulate exine, granulated, lumina 4-5 μ in diameter, decreasing much in size towards the colpus and pore margins, simplibaculate and columellae minute. My observations based on pollen grains of subspecies *australiense*, differ in several important respects from his description.

In the first place, it seems more appropriate to give a sound background in terminology for describing the exine. The mature pollen grain is enclosed in a double wall structure; an inner one called *intine*, an outer, *exine*. The exine can usually be resolved into two principal layers; an inner and an outer, the former is called *endexine*, the latter, *ektexine*. A typical ektexine may be regarded as a tripartite structure; an inner stratum as *foot layer*, *columellae* and an outer stratum as *tectum*. If the tectum covers more or less completely, the grain is *tectate*. Grains in which the tectum is partially absent are called *semitectate*. Various names and classifications have been applied to different subdivisions of the exine. The different terminologies often reflect the various purposes for which the pollen is being examined.

The structure and sculpturing of the exine provide characters of great diagnostic value. According to Faegri & Iversen (1964, p. 20), "the term structure comprises all those characters which are due to the form and arrangement of the exine elements inside the tectum." The term sculpturing, on the other hand, "comprises the external geometrical features without reference to their internal construction."

Figure 1 shows a whole pollen grain of the subspecies in the scanning electron microscope at a slightly oblique equatorial position with one of two longer colpi in face view. Figure 2 presents a detail of the exine surface on the intercolpium, an area delimited by two adjacent colpi, showing the granules within the reticulum. Compare these pictures with those seen in the light microscope as shown in Figures 7-12 of the Plate 72 by Ohashi, loc. cit. Two pollen grains in successive foci in these figures

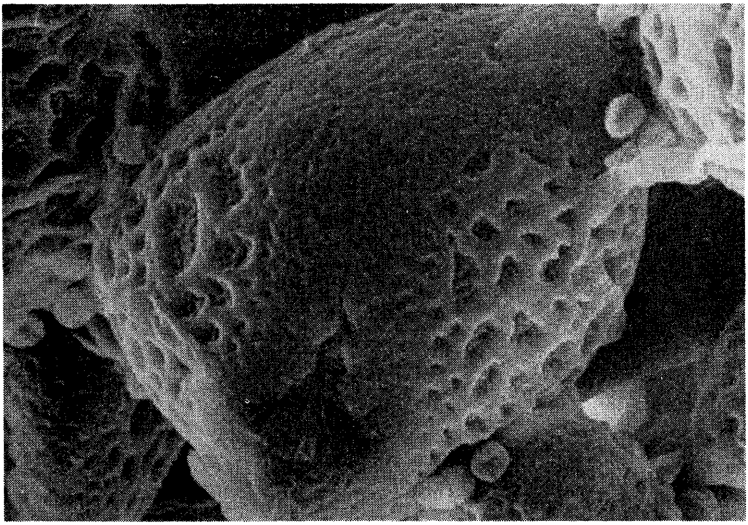

Fig. 1. *Dicerma biarticulatum* subsp. *australiense* (Tindale, s. n., NSW 105342). Pollen grain in a slightly oblique equatorial position showing one longer colpus in face view. SEM ×2400.

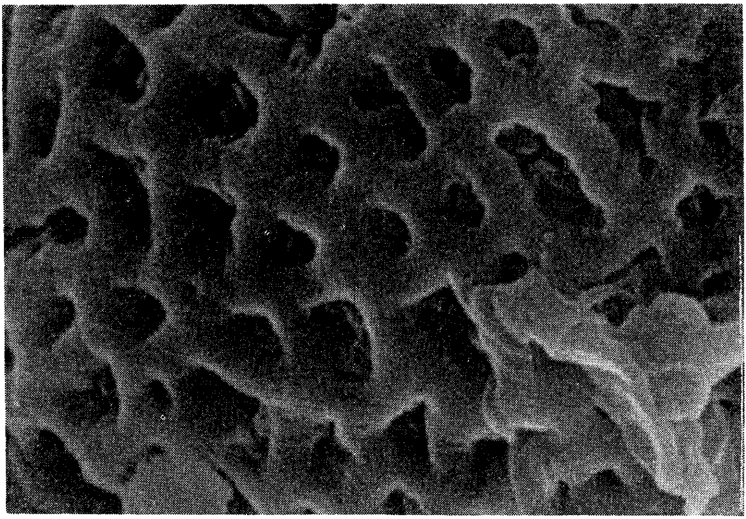

Fig. 2. The same. Detail of the intercolpium of the exine surface showing granules within lumina and minute wrinkles on muri. SEM ×6000.

of the same plate show what appear to be a "reticulate" pattern. The view corresponds with the present observation by means of the scanning electron microscopy. In this instance, however, it seems more appropriate to describe the exine as "per-reticulate" rather than as "coarsely reticulate." The former term "per-reticulate" was introduced by Faegri & Iversen (loc. cit., p. 16) for a subdivision of the semitectate in which the structural elements of the exine are fused distally forming a continuous reticulum with open lumina.

A very noticeable divergence between Ohashi's description and the present study concerns the structure and sculpturing of the exine extended near the colpus margin. Scanning electron micrograph presented here clearly demonstrates that the exine of the particular area consists of a continuous tectum provided with delicate and narrow concavities spaced rather closely. In this pollen, optical effects which emphasize the borders of the concavities produce an appearance of reticulum beneath the tectum, a pseudo-infratectal reticulum, at successive levels of focus in the light microscope. The "smaller size of lumina near the colpus margin" seen in the light microscope is actually delicate concavities or shallow depressions in the tectum.

Furthermore, the columellae described by Ohashi are not found in any of his micrographs as either black or bright dots. The "columellae" seen in the light microscope are proved to be granular structure and not infratectal supporting elements. It is also interesting to note that the scanning electron microscope often reveals new pollen characters unobservable in the light microscope. Such was the case in the discovery of minute wrinkles - wavy appearance - on the muri, which may be correlated with those of other member of the genus.

The present study shows an important palynological distinction between a light micrograph and a scanning electron micrograph ; the former shows both structure and sculpturing, while the latter shows only sculpturing. Thus, the light and scanning electron microscopes are complementary each other and can give aid jointly in the elucidation of exine structure and sculpturing.

Literature cited

Faegri, K. and J. Iversen 1964. Textbook of pollen analysis. 2nd ed., Munksgaard, Copenhagen, 237 pp. Ohashi, H. 1973. The Asiatic species of *Desmodium* and its allied genera (Leguminosae). Ginkgoana, 1, Tokyo, 318 pp.

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Dicerma biarticulatum の花粉形態の記載は大橋（1973）によって光学顕微鏡で行なわれた。本論文では *D. biarticulatum* subsp. *australiense* の花粉を走査電顕で観察した結果を報告した。溝の周辺部の外膜は網目模様ではなく凹点が多数散在し (Fig. 1)，これらが光学的に微細な網目模様に見える。また，外膜には柱状体の発達はなく小顆粒が階層構造の構成要素であり，さらに光顕では観察不可能であつた網目の畝には細かな波状模様が発達していることが観察された（Fig. 2）。

○Materials for the distribution of lichens in Japan (2) 地衣類分布資料 (2)

○**Lobaria pulmonaria** (L.) Hoffm. This species is widely distributed in the Northern Hemisphere, Africa, and Mexico (Yoshimura & Hawksworth, Journ. Jap. Bot. **45**: 33-41, 1970). In Japan, however, it has been reported from only one locality in central Hokkaido (Yoshimura, Journ. Hattori Bot. Lab. **36**: 497-498 1972). Among my own collection of lichens, I recently found another specimen of this species collected in northern Hokkaido. In the specimen, only norstictic acid is demonstrated as lichen substance and it can be considered to belong to the chemical strain II in the sense of Yoshimura & Hawksworth. The occurrence of *L. pulmonaria*, especially the chemical strain II, therefore, is expected through central to northern Hokkaido, where the species seems to be still rather rare.

Specimen examined. Wakasakanai, Toyotomi-machi, Prov. Teshio, Hokkaido, S. Kurokawa 70651 (TNS). (Syo Kurokawa)

Lobaria pulmonaria はカブトゴケ属の代表種として一般にもよく知られ，日本ではその変種や品種も報告されていた。最近の吉村庸氏の研究では，これらの変種や品種の大部分は別の種として扱われ，粉芽をもつ狭義の *L. pulmonaria* コナカブトゴケは日本では非常に珍らしく，その産地は北海道中部の1ヵ所だけとなった。ここに報告する北海道北部での発見は，日本での第2の記録である。（黒川　逍）